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THE BRITISH GRASSLAND SOCIETY

The British Grassland Society was first formed in 1945. In a foreword to the first issue of the Journal of the Society* which we have just received Sir R. George Stapledon says "The formation of the British Grassland Society may truly be said to be the evolutionary outcome of the ever growing attention given to grassland problems by agricultural scientists. An evolution that received great stimulus from the late Sir William Somerville's far-reaching manuring for mutton experiments; and was given a still wider basis for expansion when the late Professor Gilchrist brought the basic slag, the white clover and the best grasses together in the ley. The result has been that in more recent years much intensive study has been bestowed upon individual species and strains of grasses and upon the nutritive value of herbage: and now geneticists, plant breeders and biochemists have been brought into the gambit of grassland research. The full extent and wide range of the problems affecting grassland, and equally of the problems affected by grassland, were forcibly brought home to all of us by the papers read at the Fourth International Grassland Conference, which was held in Britain in 1937: and to-day there are men who are specialists in all sciences embraced by the elusive term "agricultural science", who are actively apprenticing themselves to what amounts to the new science of grassland. It was at the Fourth International Grassland Conference that the idea of forming a British Grassland Society was first considered, but at that time the number of men officially devoting most of their energies to grassland was not nearly so great as now, while the gathering clouds of world-wide disaster tended to dull the enthusiasm even of scientists. The brotherhood of endeavour which has been responsible for the turning over and under of so many millions of acres of permanent grass, ironically enough, has been the major cause that has rekindled enthusiasm and which has been the decisive factor responsible for the starting of our Society."

* *Journal of the British Grassland Society*. Vol. 1, No. 1, 1946. Subscription to 1946 Volume: Ten Shillings. Obtainable from the Secretary, British Grassland Society, Agricultural Research Building, Penglais, Aberystwyth, Cards.

" A Society born of grassland, wedded to grassland and which aspires to be the parent of great advances in the technique of the full exploitation of " grass ", by virtue of its pedigree and heritage would seem necessarily to have imposed upon it the duty of sponsoring a Journal ".

This Journal has now become an accomplished fact. It will be devoted wholly to grassland problems and is not only a welcome new addition to our agricultural literature but also will meet a long-felt want. We are glad to note also that its pages will be open to contributors not only from Great Britain but also from the British Commonwealth of Nations and Empire and from foreign countries.

The first number includes articles on the output of pasture and its management, and on the rôle of silage in grassland management. There are two other papers also : one on the leather-jacket problem on re-seeded grassland in Yorkshire and the other on the productivity of reclaimed upland areas in Wales. The issue concludes with Sir George's presidential address which was delivered at the opening general meeting of the Society. In this address Sir George draws attention to the outstanding fact that to-day in England and Wales permanent grass at less than nine million acres stands at a lower figure than at any time since crop and acreage statistics have been collected, while a real beginning has been made in the direction of ploughing-up, cropping and regrassing selected areas of rough grazings at elevations going right up to and even above the 1,500 ft. contour. It is the intention of farmers, he says, to establish leys not as a stepping stone back to permanent grass but as the pivotal crop in rotations and thus to build into a system-ley farming—that will assist them to fight their strenuous battles with a world no longer at war. In his view the era of permanent pasture as it has been known in England and Wales is ended : an era when systems of farming over the preponderate acreage of the country were based wholly or chiefly on permanent grass. He does not go so far as to suggest that there is no longer a case for permanent grass anywhere in Britain but asserts that never again will permanent grass exercise the dominating influence on the minds of agricultural scientists interested in grass, nor on the minds of farmers and still less on the landscape of most of the country. Thus, in his opinion, the grassland problems of the future will centre almost wholly on the ley. " Our duty," he says, " as scientists and technicians is briefly to labour with a view to making the ley foolproof in all respects, and in all places, as a safe and nutritious feed for animals at all times and as a thriving crop under all circumstances—foolproof alike on the poor lands and the fat lands." He considers grass as the stepping stone between the fat and the poor lands. " There is " he says, " no hard and fast line of demarcation between the good and poor lands, that has been the outstanding agricultural lesson of the war, taught to us chiefly via grass. This lesson however has not permeated very deeply yet, but at least it has ceased to be a secret known only to progressive grassland agronomists. It is all a matter of how we use, of how we crop, and how we maintain the good and poor lands respectively in relation to each other. That, in my view, is the crux of the whole grass problem, and the core around which there is the greatest hope of building a sane agricultural policy that will equally benefit every parish in the country and the rural community as a whole, and so confer upon rural Britain that sense of mutual endeavour and enterprise that can alone sustain stability and spell prosperity ".

CYANAMID FOR WEED CONTROL

Tobacco farmers have laboriously met the problem of keeping down weeds in tobacco seed beds by maintaining huge bonfires of brush and logs on a tobacco plant bed, prior to seeding, so as to sterilize the soil and reduce the number of weeds per square yard. This process was expensive of labor and material, and only partially successful. Alternatively a large portable steam boiler would be brought to the plant beds by a contractor, who would endeavor to sterilize the soil with steam jets. This, too, proved only partially satisfactory, one of its chief disadvantages being the expense.

Heavy applications of cyanamid have solved this old problem ! Cyanamid is normally used, alone or as an ingredient in mixed fertilizers, to replenish nitrogen in soils. Used in great excess it can ' burn ' a crop temporarily although it duly stimulates growth subsequently. Hence came the idea of deliberately using enough to kill plant life in the top two or three inches of tobacco seed beds, waiting sixty to ninety days for the breakdown of the cyanamid into lime and nitrogen and then planting tobacco seed in the weedless soil.

The lavish supply of nitrogen is beneficial to the growth and sturdiness of the tobacco seedlings and thus diminishes losses incident to transplanting.

This method of soil sterilization has come to be recognized by agricultural experiment stations, as well as by growers, as the most satisfactory means of weed control.

It is now a well-established and accepted practice to use one pound of cyanamid per square yard of tobacco seed bed. The Georgia Coastal Plain Experiment Station relates that in its own control experiments in 1943, a check plot produced 1,971 weeds per square yard, whereas in a comparative plot where one pound of cyanamid was applied, only 20 weeds made their appearance.

The seed beds require no hand weeding, easing the grower's labor problem in these years as well as reducing labor cost. On a typical tobacco farm the saving of payroll over the costs of fire or steam sterilization is upward of $600 a season. (Abstracted from *For Instance*, American Cyanamid Company, No. 6, 1945).

OBSERVATIONS ON THE REPRODUCTION OF ZEBU CATTLE IN SOUTHERN NIGERIAN DAIRIES

BY

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Introduction

IN the past the milk supply of the Southern Provinces of Nigeria has been obtained mainly from tins but with the advent of the War supplies were considerably reduced and at times serious shortages occurred. The resultant demand for milk led to the establishment of two private dairies, one in Lagos, and the other in Ibadan. A little later, the Agricultural Department established a small one; primarily for supply to the army, at Moor Plantation, Ibadan. All these dairies were stocked with Zebu cows of the White Fulani and Shuwa types from the herds of the Agricultural Department in the Northern Provinces.

In common with most areas in the Southern Provinces, these places are situated in the "fly" belt and it was thus necessary to protect the cows from the tsetse fly (*Glossina palpalis*) by erecting fly and mosquito-proofed cowsheds. The cows are confined within these buildings throughout the day except for a short period of approximately one hour, at dawn, allowed for exercise. Under these conditions it has been possible to produce good quality milk and partially to offset the shortage of imported tinned milk.

In so far as general health is concerned, the cows in these dairies have done very well indeed. Milk yields have been well maintained, and there has been a pronounced tendency for the animals to put on weight. The reproductive efficiency of the cows has been considerably reduced, however, and it was found that the interval between calvings was considerably longer among the cattle in these dairies than in the Northern Provinces, with the result that many of the cows have completed their lactations without becoming in calf.

The Service Period

For maximum efficiency in breeding and therefore in milk production it is necessary that the period between calving and subsequent conception, the "service period", should be reduced to a minimum having due regard to the maintenance of the health of the animal.

In England, the average service period for British breeds (*Bos taurus*) was found to be 97 days by Hammond (1). Information about length of the service period for Zebu (*Bos indicus*) cattle in the tropics is somewhat meagre, and most of the data come from India. Sayer (2) has observed that the length of the service period of the Indian Sahiwal breed is 90 days under natural conditions but that it increases to 159 days when the animals are forced for milk production. Ware (3) has stated that the service period for Sahiwal cattle is 125 days. Dave (4) found the average service period for the Red Sindhi breed to be 87 days.

From the foregoing, it would appear that in India at least the service period of the Zebu is in the region of 90-130 days, which implies that the cows will calve every 12-14 months and may be considered satisfactory.

Data collected from the records of White Fulani cattle at the Shika Stock Farm in the Northern Provinces where the cows are kept under more natural conditions have shown that the average service period for a total of 233 cows is 83 days, a figure which agrees with the results obtained in India.

In the Southern Provinces, however, the position is by no means as satisfactory as in the North. A brief investigation of the Lagos and Moor Plantation dairies was carried out by the writer in 1943 by which time the former dairy had been taken over from the original owner by the Agricultural Department. This revealed that in the Southern Provinces only 86 of the 113 cows whose records were examined had been served and that the remaining 27, whose service period had been 116 days under Northern conditions, had already been in the South for 160 days. These figures may indicate that cows with longer service periods in the North may be more difficult to get in calf in the South. It should be noted that out of the 86 cows which were served in the South, 50 were not in calf when they were sent down, having been in the North for an average of 82 days prior to shipping. This leaves only 36 cows which were in calf on arrival in the South, and were again served here. These cows had a service period of 161 days for the South as compared with 83 days in the North.

The long service period which occurs in southern dairies is therefore likely to prove a serious obstacle to further development of the industry. The expenses of running such dairies will be increased by the necessity either of shipping cows back to the North when dry, as is practised at present, or of keeping them in the South at high cost during a long unproductive dry period. As a result, in February 1944, the writer began investigations at the Lagos dairy to study causes of the longer service period occurring in the Southern Provinces.

Regular weekly visits were paid to the dairy, at which times the calving records were examined so that cows over-due service could be noted. The reproductive organs of all cows for which no service had been recorded within 83 days of calving were examined *per rectum* in an attempt to determine the cause of the delay. During the period of 9 months covered by the investigations 63 cows calved; of these 36 failed to come on heat within 83 days of calving.

At the first examination, cows were separated into groups according to the degree of ovarian development exhibited. Results are given in Table I.

Table I

Cows in calf...		4
Cows overdue service :—		
(1) With apparently normal ovaries ...	20	
(2) Showing no sign of ovarian development...	7	
(3) Showing signs of subnormal ovarian development	4	
(4) Showing abnormal development ...	1	32
		36

According to Table I the majority of cows showed no sign of any ovarian irregularity which could account for the long service period: in every case vestigal corpora lutea, follicles, or signs of recent ovulation were found. Apart from the fact that no sign of oestrus had been observed, there appeared to be no reason why these animals should not have been served. In order to reduce to a minimum failure to serve cows through signs of heat being unobserved by attendants it is the practice at this dairy to have the bull out with the cows when they are at exercise in the early morning. It seems possible therefore that lack of desire on the part of the cows is responsible in those showing no abnormality since there was no evidence that the bull was undersexed.

Seven of the cows showed absolutely no sign of ovarian development: the ovaries were small and no corpus lutem or follicle could be detected. It was therefore concluded that these animals were inactive in so far as their ovaries were concerned.

A further four animals had ovaries which were smaller than normal but showed some slight signs of activity: they were therefore classed as showing subnormal development.

Four of the thirty-six were found to be in calf (although there was no record of service having taken place) and the ovaries of one animal were so abnormal that diagnosis was impossible.

Methods of Treatment

The work carried out on these animals comprised manipulation of the ovaries, injections with a synthetic oestrogen (stilboestrol) and injections of a proprietary brand of pregnant mare's serum. The decision as to which method of treatment should be adopted for an individual was based on the condition of the ovaries as revealed by the preliminary examination. It was possible, by means of subsequent weekly examinations of the ovaries, to observe and note down any changes occurring as a result of the treatment adopted.

In some cases it was possible to decide on the method to be adopted as a result of the preliminary examination, but in others it was necessary to follow through the changes taking place in the ovaries over a period of several weeks before it was possible to come to any decision. Out of the 32 animals whose services were overdue, seven, whose oestrous cycles appeared normal, were served whilst under observation, and before any treatment had been carried out on them. The experiments which are described below were carried out on 22 of the remaining 25 animals.

Ovarian Manipulation

Ten of the cows were dealt with in this manner and the results are summarised in Table II. As the table shows, removal of the corpus luteum (enucleation) was the most commonly practised technique because whenever examination revealed, as it frequently did, the presence of a fully formed luteal body, enucleation was carried out as a routine measure.

Only one of the cows came on heat and was served within the normal period of 4 to 6 days mentioned by Hammond (5). Another was seen on heat after eight days, but owing to lack of interest on the part of the bull, no service was effected. It is difficult to account for the long delay in this case, but one possible explanation is that enucleation was not completely carried out, and that some portion of the luteal tissue was left behind in the ovary.

The routine examinations revealed that ovulation had followed enucleation on four other occasions, although no sign of heat was observed. As all these animals were served within a short period, it may be that although no immediate response was noted, the operation was to some extent responsible for the subsequent services.

In two cases there was no marked response; one of the animals was thought to be on heat 14 days later, but no service was effected for some considerable time, so it may be concluded that treatment was ineffective in this case. The other was given two injections of pregnant mare's serum, because no reaction was observed following the removal of the luteal body. Although she was served later, it is doubtful whether either method of treatment was of any value.

The ovaries of the cow were massaged, at weekly intervals for a period of roughly eight weeks, before she showed any signs of heat, but she was not served until 3 weeks later.

Stilboestrol

Injections of this synthetic oestrogen were given to eight animals which showed little or no signs of ovarian development. Details are given in Table III.

Only one of the eight cows treated failed to give any response to the drug, and as she was sent to the North later on it was not possible to follow up this occurrence.

Four of the cows were served within five days of being given injections. They did not settle to this service and were all served again later; this is in no way abnormal for it has been stated

by Folley and Malpress (6), that it is not unusual for cows which are served as a result of an injection of Stilboestrol to return to the bull for a second service, which is usually successful.

Three cows responded only slightly to the first injection; no signs of heat were noticed, but there were indications of increased ovarian activity and services were effected after a second injection had been given. As two of these cows were only given 10 mg. at the first injection, it is possible that this quantity was inadequate, judging from the fact that of five which were given 15 mg., 4 came on heat immediately.

Miscellaneous

The remaining four cows were treated in various ways as will be seen from Table IV. Three of them were given injections of 1000 to 1200 i.u. of pregnant mare's serum but the response obtained was only slight; increased ovarian activity was noted, but in only one case does it seem likely that the serum produced any result.

Discussion

In the preceding pages reference has been made to the abnormally long interval between calving and subsequent appearance of heat which occurs under the intensive system of dairying practised

Table II

Ovarian Manipulation

No. of cow	Date calved	Date examined	No. Days calving treatment	Diagnosis	Treatment	Date served	Date calved	Remarks
240	14/ 8/43	11/ 2/44	180	Functioning	c.l. removed and served successfully in 4 days	15/ 2/44	26/ 2/45	—
2 5	13/ 2/44	13/ 6/44	119	Functioning	c.l. removed 13/6/44. Heat, no service 21/6/44 (Bull sluggish), but served on 13/7/44	13/ 7/44	15/ 4/45	—
32	22/ 9/43	16/ 2/44	146	Functioning	c.l. removed on 16/2/44. Ovulation noted, but no heat, repeated on 24/3/44, with same result. Finally served	25/ 4/44	1/ 2/45	—
312	26/ 8/43	11/ 2/44	168	Functioning	c.l. removed 25/2/44. Ovulation noted, but no heat. Served later.	17/ 4/44 4/ 5/44 12/ 6/44	—	Sold
130	16/11/43	25/ 2/44	100	Partial functioning	c.l. removed 16/3/44. Ovulation but no heat; heat no service 11/4/44; served subsequently	25/ 5/44 18/ 4/44	7/ 3/45	—
320	9/ 8/43	16/ 2/44	190	Functioning	c.l. removed 16/2/44. No heat, served later	7/ 5/44	—	Sold
87	18/ 6/44	7/ 9/44	80	Functioning	c.l. removed 7/9/44. Heat suspected 21/9/44 and no service	26/12/44 18/ 3/45	—	—
152	16/10/42	11/ 2/44	488	Partial function	c.l. removed 16/2/44. No reaction; given 1300 i.u. Serogan 16/3/44, slight response, further 1300 i.u. Serogan 9/4/44—heat suspected 16/4/44. Served later	1/ 5/44 15/ 5/44	—	Sold
255	18/ 1/44	5/ 6/44	137	No function	c.l. removed 5/6/44. Ovulation but no heat observed, served later	28/ 6/44	—	Sold (in calf)
119	23/ 4/44	4/ 7/44	71	Functioning	Ovaries massaged weekly. Heat suspected 30/8/44 but no service till 3 weeks later	21/ 9/44	—	In calf

Table III

Stilboestrol

No. of cow	Date of last calving	Date examined	No. of days calving examined	Diagnosis	Treatment	Date served	Date calved	Remarks
291	9/ 8/43	16/ 2/44	185	No function	10 m.g. stilboestrol on 11/2/44 and served the next day	12/ 2/44	10/ 2/45	Calved to service on 5/5/45 approx.
053	1/ 2/44	13/ 6/44	131	Partial function	15 m.g. stilboestrol on 28/6/44 ; and 29/7/44	—	—	No results. Sent to North on 10/8/44 and no further investigation possible
258	30/11/44	25/ 2/44	86	No function	10 m.g. stilboestrol on 1/3/44 : ovulation took place subsequently and corpus luteum formed. No service recorded but heat suspected on 2/3/44. No further heat, so given 15 m.g. on 5/6/44 and served	7/ 6/44	Sold	Thought to be in calf when sold
145	18/ 2/44	13/ 6/44	114	No function	15 m.g. stilboestrol on 28/6/44, and served two two days later	30/ 6/44	9/ 5/45	Calved to service on 1/8/44 approx.
159	24/ 2/44	13/ 6/44	107	No function	15 m.g. stilboestrol on 28/6/44, and served two days later	30/ 6/44	—	Served again 30/8/44
108	13/ 3/44	4/ 7/44	112	Functioning	10 m.g. stilboestrol 25/7/44 : heat but not served. Given 1200 i.u. Serogan on 23/8/44, no heat observed, but ovulation noted	25/ 9/44	Aborted	
046	22/12/43	18/ 7/44	207	No function	This cow was thought to be in calf, but found to be empty on exam. 15 m.g. stilboestrol on 18/7/44 no heat observed, but served later	18/ 8/44	—	Served again 5/9/44 now in in calf.
047	14/ 5/44	16/ 8/44	93	Partial function	15 m.g. stilboestrol 16/8/44 and served four days later	20/ 8/44	—	Served again 21/12/44

Table IV

Miscellaneous

No. of cow	Date calved	Date examined	No. days calving treatment	Diagnosis	Treatment	Date served	Date calved	Remarks
418	25/11/43	25/ 2/44	91	No function	1000 i.u. pregnant mare's serum on 1/3/44. Ovaries showing slight signs of activity subsequently ; further 1200 i.u. on 18/4/44 only slight changes produced in ovaries	13/ 5/44	—	Sold
160	30/ 7/43	16/ 2/44	200	No function	1000 i.u. pregnant mare's serum 16/2/44. Heat 26/2/44 but not served. c.l. removed 10/3/44, no heat observed. Heat suspected on 3/4/44	—	—	Animal sold 18/4/44
314	30/10/43	16/ 2/44	108	Partial function	1000 i.u. pregnant mare's serum 16/2/44, slight response but no signs heat. Further 1000 i.u. on 25/4/44– served 10 days later	5/ 4/44	13/ 2/45	—
059	31/ 5/44	16/ 8/44	76	Functioning	Examined found to have only recently ovulated. Put in service crate and force mated successfully	17/ 8/44	—	Sold, but in calf

in the Southern Provinces of Nigeria. The herd records show that the service period of the Southern Provinces is approximately twice as long as it is in the north, and it is obvious that if some means of reducing this period can be found the present high cost of milk production will be considerably reduced. Such a step would render dairying a much more attractive proposition, and might be expected to lead to an extension of the system to other centres of population in the Southern Provinces, with its attendant benefits to the community.

It is probable that the longer service period which occurs in the south is largely due to the unnatural conditions under which the animals are kept, and as it appears impossible to do anything further to alleviate these the only solution to the problem is to find some artificial means of bringing the animals on heat sooner.

The investigations revealed that the reproductive organs of more than fifty per cent. of the animals considered to be overdue service were normal, and that the oestrous cycle was following its normal course, with ovulation occurring at regular intervals although signs of heat were completely absent, a condition known as " silent heat ".

In order to reduce the service period, it will be necessary either to determine when oestrus is occurring, so that the cow may be put in a service crate and mated, or artificially inseminated, or else to find some means of increasing the intensity of oestrus, so that the outward signs may be rendered more obvious.

At oestrus, the cervical mucus which seals the *Os uteri* becomes more fluid than at any other time in the oestrous cycle. It is possible to measure the viscosity of this mucus by means of the oestroscope, an instrument described by Scott Blair and others (7), with which the time of oestrus can be determined even when external symptoms are absent. Two of these instruments were purchased, and after being given training in their use, an assistant was given the task of making routine determinations of the viscosity of the cervical mucus of a selected number of cows at the Lagos dairy. Unfortunately, both the instruments were broken before it was possible to obtain any definite information as to their value. It is to be hoped however that a further trial will be made with this instrument as it appears to offer one possible solution to the problem with which we are faced.

As a result of this mishap most of the experimental work has been devoted to finding some means of increasing the intensity of oestrus in those animals exhibiting silent heat to such an extent that it can be readily detected by those in charge of the cattle. At the same time treatment was carried out on those animals showing partial or complete lack of ovarian function.

The oestrous cycle is under the control of the gonadotropic hormones of the anterior pituitary, known as the follicle stimulating, and luteinising hormones respectively. The former controls follicular growth and therefore oestrogen production ; while the latter assists in the rupture

of the developed follicle and formation of the corpus luteum; which in turn produces yet another hormone, progesterone which inhibits the production of follicle stimulating hormone. As the external symptoms of oestrus are produced by the oestrogens, it follows that if the follicle stimulating hormone is present in insufficient quantity, the outward symptoms of oestrus may be considerably reduced or even be absent, although the reproductive cycle may continue to follow its normal course.

A similar effect may result if the luteinising hormone is present in excess, since this hormone can indirectly inhibit the production of the follicle stimulating hormone.

It seems possible therefore that the occurrence of silent heat in some of these cows may be due to one or the other of the irregularities described above; and that if the balance of hormones can be supplemented from some external source, normal heat symptoms may be expected to occur.

Three methods of restoring the balance of the ovarian hormones were tried out; stilboestrol, pregnant mare's serum, and enucleation of the corpus luteum; of these three, stilboestrol appears to offer the best possibilities of success. It is unfortunate that this drug was employed for the most part on those animals which showed no ovarian development, for judging by the successful results obtained it should prove very useful on those exhibiting silent heat. However, before any extensive use is made of this drug, it will be necessary to carry out careful experiments to determine the optimum dosage in order to avoid any possibility of an overdose causing cyst formation in the ovaries.

Pregnant mare's serum, a proprietary brand of gonad-stimulating hormone has the same action as the follicle stimulating hormone of the anterior pituitary. The results obtained were, however, rather disappointing, but possibly the dose employed was inadequate. It was found that stilboestrol was more effective when used at a higher rate than that recommended for temperate countries, so it is quite possible that the same applies to pregnant mare's serum : time however did not permit of further investigations into the matter.

Removal of the corpus luteum was the technique most commonly practised on those cows which appeared to be showing silent heat, but again the results were not very encouraging. Two cows came on heat, but all the others appear to have continued to ovulate as before, without showing any external signs of oestrus. It is suggested that a trial should be made of the administration of pregnant mare's serum at the time the corpus luteum is enucleated, for the former has been shown to produce a slight increase in ovarian activity, and a combination of the two might produce the desired results.

It is difficult to offer any satisfactory explanation for the complete absence of ovarian activity shown by seven of the animals. It seems possible however that this may again be due to inadequate production of the gonadotropic hormones of the anterior pituitary resulting from the unfavourable conditions under which the animals are kept. The experiments have demonstrated that these irregularities can be overcome, and it would appear that stilboestrol injections are the most promising. The dose of stilboestrol employed is greater than that recommended for temperate countries, and it would appear that in an unfavourable environment it is advisable to employ greater quantities when using hormones to combat reproductive troubles.

Summary

It has been observed that the service period of Zebu cattle when transferred to the Southern Provinces dairies is twice as long as under Northern Provinces conditions.

Examinations carried out on a number of cows whose service was overdue revealed that while the occurrence of silent heat is the main source of trouble, the ovaries of some appear to be quiescent, and some only show very slight signs of activity.

Experiments are described which were designed to reduce the service period.

An accurate means of diagnosing heat might render it possible to settle those cows which are functioning, by serving them when confined in a service crate.

Acknowledgments

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The Editor is prepared to consider signed articles for publication in *Tropical Agriculture*. Such articles should normally vary between 1,000 to 6,000 words and may be illustrated if desired.

"SAMARU 26 C" A NEW STRAIN OF COTTON BRED IN NORTHERN NIGERIA

BY

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(I) Introduction

IN Northern Nigeria cotton is grown as one of the main cash crops of the peasant farmer, the annual export varying between 10 to 60,000 bales of 400 lb. each. Yields on native farms are very low and have been estimated at between 150 and 200 lb. of seed cotton per acre. These low yields are, however, fortunately due to prevailing agricultural practices and not to any limiting environmental conditions; local farmers (very wisely) give priority to the planting of food crops, and cotton is often planted very late and is used to a large extent as a catch crop on new land cleared in one rainy season in preparation for a grain food crop in the next season.

The breeding work described in this article was carried out at Samaru, a Government Experimental Station situated in the main cotton belt of Northern Nigeria. The average rainfall is as below:

January	...	—	July	...	8.72
February	...	0.05	August	...	1.70
March	...	0.34	September	...	8.71
April	...	1.45	October	...	1.44
May	...	5.31	November	...	0.04
June	...	6.61	December	...	0.01
			Total	...	34.38

Lat. 11° 11'N Long. 7° 38'E Altitude 2,240 ft.

The recommended planting date is 1st July and harvesting usually commences towards the end of November.

The variety grown commercially is a long staple variety of *Gossipium hirsutum* known as "Allen", and the following is a brief history since its introduction by Mr. P. H. Lamb in 1912.

When first introduced it was grown for many years on the seed farm at Maigana and, as no selfing was done, it had ample opportunity for crossing with the local "Gwundi" (*G. pervianum*), "Georgia" and "Nyasaland". After 1918 it was grown in much stricter isolation but since mass selection had been done during the time when it was not isolated, it is very possible that some hybrids were amongst the crop. Mass selection was continued until 1922 when Dr. Mason made the first single plant selections and from that date the work of single plant selection and controlled selfing has continued.

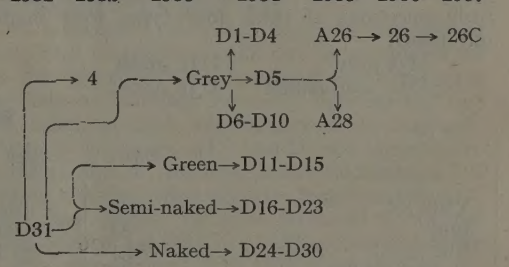
The main aim of the plant breeder at this time was to improve the quality of the crop without reducing yield. Early results however were not successful, and the policy was later altered so that the main objective was to concentrate on yield per acre and breed a type with increased yield but having a quality valuation at least as good as that of commercial "Allen."

With this aim in view many new first selections were made from the commercial crop in 1931 and grown in progeny rows in 1932.

It is from one of these plants—D31—that the strain now called 'Samaru 26c' has been derived by continual single plant selection and in this article the full history of Samaru 26C will be traced back to the original selection made in 1931.

The relationship of all the derivatives of plant D31 which are mentioned in the article are shown in Table I and from these it will be seen that the direct line of descent of Samaru 26C (henceforth called 26c) is D31 (1931)—D31 (1933) (bulk grey)—D5 (1934)—A26 (1935)—26 (1936)—26c (1937). The year given in brackets indicates the year in which the selection was first made.

Table I



(II) Units of Measurement

In all the tables which follow, yields are recorded in lb. per acre. Length is in thirty-seconds of an inch.

M.H.W. = Mead hair weight per cm. × 10^{-5} Mgm.
H.S.C. = Highest Standard Count or the highest count estimated to give a lea product as great as 2,000.
C × S = Count × Lea Strength at that count and is also referred to as "Lea Product".
C × W.R = Count × work of rupture at that count.
Points = The Brokers valuation in points (+ or −) compared with American futures (100 points = 1 penny).

(III) Season 1932

From the progeny rows of all the first selections made in 1931, D31 was one of the rows selected because it had the highest ginning percentage (35.5 per cent.); it had the 3rd highest yield of seed cotton; it had the highest lint length (rough laboratory estimate) and it was also generally healthy and free from disease. One plant only was selected (strain 4) and the remainder was bulked for a yield trial.

(IV) Season 1933

This bulked seed of D31 was tested in trial No. A4 (33) and samples were sent to the Shirley Institute for testing. The results are given in Table II.

Thus D31 had proved itself good as regards yield of lint (30 per cent. increase) and ginning percentage. It was however more immature and had more short hairs than Allen which was a bad characteristic since Nigerian cotton always suffers from immaturity. The most disappointing result however was the fact that it was definitely weaker than Allen and this was surprising since it had a slightly lower hair weight and a slightly higher effective length.

Strain 4, the single plant selected in 1932, was in a progeny row this year and more selections were made but when it reached the stage of a small trial in 1934 it, and its progeny, were discarded as it failed to give the increase in yield and ginning percentage of the unselected bulked D31.

No single plants were selected from the bulk D31 this year but it was multiplied up to provide sufficient seed for a series of trials in 1934. It had also been noticed from the beginning that D31 was very variable and it was easy to divide it into four distinct types on seed characters alone. Bulk selections of these four types were made and named :—

D31 grey	D31 green
D31 semi-naked	D31 naked

(V) Season 1934

The bulked seed of D31 was in trials on three of our farms, namely Samaru (trial B1 (34)) Kano and Gusau. Kano and Gusau are north of Samaru and in a belt with a lower rainfall which is less suitable to the growing of cotton.

Samples from all these trials were sent to the Shirley Institute with their respective controls and the results are summarised in Table III.

The definitely lower strength of D31 was again apparent and there was nothing in the measured hair characters that could account for this weakness. On the average it had a higher percentage of short hairs and a higher hair weight. The measured hair characters of the samples from Kano were practically identical and yet the yarn from D31 was much weaker.

Another interesting point was that in each case the broker valued D31 higher than Allen in spite of the weakness of the yarn.

The bulked selections made in 1933 were grown this year and single plant selections made as below :

Plants D1 -D10	From D31 grey
,, D11-D15	,, D31 green
,, D16-D23	,, D31 semi-naked
,, D24-D30	,, D31 naked

These plots did not all come true to type and D5 which is the one we are most interested in was actually a semi-naked type. The ginning percentage for this plant D5 was 35.8 which was about the average of the selected plants.

Table II

	D31	Allen		D31	Allen
Yield S.C.	243	204	Mean length	26	27
Lint	83	60	Effective length	37	35
Gin %	34.1	29.3	% dispersion	30	24
% increase lint	39	—	% short	31	26
C×S at 50's	1995	2235	% normal	37	45
C×W.R. at 50's ...	2590	2766	% dead	28	21
Points	—	—	M.H.W.	150	156
			H.S.C.	49	61

Table III

	Samaru		Kano		Gusau	
	D31	Allen	D31	Allen	D31	Allen
Yield S.C.	308	242	289	223	326	278
Lint	101	70	95	65	107	81
Gin %	32.8	29.0	(32.8)	(29.0)	(32.8)	(29.0)
% increase lint	44	—	46	—	32	—
Mean length	25	27	27	25	26	28
Effective length	35	36	40	39	37	37
% dispersion	26	25	29	28	29	29
% short	31	25	29	30	31	22
% normal...	47	39	52	50	57	51
% dead...	14	18	14	12	12	19
M.H.W.	180	163	166	163	182	176
H.S.C.	29	45	40	51	32	42
C×S at 40	1772	—	2007	2234	1827	2053
C×W.R. at 40	2242	—	2281	2672	2223	2550
C×S. at 50	1579	1926	1813	2029	1617	1796
C×W.R. at 50	1948	2328	2132	2288	1766	2179
Points	+50	+45	+75	+65	+60	+50

(VI) Season 1935

Bulked seed of the grey, green and semi-naked types were put in a trial this year and results are given in Table IV. The naked type was discarded.

The D31 types again proved themselves to be heavier yielders and had higher ginning percentages, but were again much weaker than Allen. Of the two D31 types sent for analysis the grey seed bulk selection was better than the green, it had a slightly greater length and was less immature and was valued slightly higher although it was slightly coarser.

The D31 green bulk type was discarded and work was concentrated on the single plant selections already made from the grey and semi-naked types.

Bulk of the original D31 was also in trial B2 (35) and gave 41 per cent. increase in lint but was again coarser and weaker (highest standard count for D31 was only 31 compared with 53 for Allen). It was however again more mature than Allen.

Table IV

	D31 grey	D31 green	D31 semi-naked	Allen
Yield S.C.... ...	751	666	771	647
Lint	250	215	246	197
Gin per cent. ...	33.3	32.3	31.9	30.4
Per cent increase lint	27	9	25	—
Mean length... ...	28	26	—	29
Effective length ...	39	36	—	39
Per cent. dispersion	29	30	—	24
Per cent. short ...	31	29	—	24
Per cent. normal ...	49	39	—	48
Per cent dead ...	11	19	—	16
M.H.W.	181	175	—	159
H.S.C.	34	34	—	53
C × S. @ 40 ...	1845	1839	—	2270
C × R. @ 40 ...	2048	1938	—	2578
C × S. @ 50 ...	1740	—	—	2083
C × W.R. @ 50 ...	1897	—	—	2220
Points	+80	+75	—	+90

(VII) Season 1936

The bulked seed of D31 (grey), D31 (semi-naked) and D31 were again tested in trial No. B1 (36). The results were similar to those of the previous year and so will not be given in detail. The increase in lint over Allen varied between 44 per cent. and 65 per cent. which was partly due to high ginning percentages (35.3 per cent. to 37.3 per cent. compared with 29.8 per cent. for Allen). Mean hair weight was again high but the other hair characters were very similar. They were however again too weak and highest standard count for the three D31 samples varied between 29 and 35 compared with 43 for Allen.

More interesting were the strains D1 to D10 which were single plants selected in 1934 from the D31 (grey) bulk. These were in trial A1 (36) and the results are given in detail in Table V.

These results were very pleasing to the plant breeder and the position seemed hopeful because at last one of the D31 selections —D5—was practically equal in spinning qualities to Allen. Its Lea-product was slightly higher than that of Allen in 40's and slightly lower in 32's and 50's. This was in spite of the fact that it had (in common with all D31 derivatives to date) a higher hair weight than Allen. D5 was in fact one of the coarsest of the selections.

As mentioned previously the poor strength of these D31 derivatives could not be accounted for by the measured hair characters and here again the only outstanding difference between D5 and the other parallel selections was its strength. The hair characters of D5 and D8 were practically identical and of the two, one would expect D8 with its slightly higher effective length and slightly lower hair weight to have produced a slightly stronger yarn, yet D8 had a highest standard count of only 39 compared with that of 47 for D5.

Selection work was continued within most of the D31 strains but only details of those from D5 will be discussed since it was from one of these that the strain Samaru 26C was ultimately selected.

Table V

	D1	D2	D3	D4	D5	D7	D8	D9	D10	Allen
Yield S.C.	495	513	486	464	491	469	541	547	499	433
Lint	174	196	186	152	166	153	198	175	178	130
Gin %	35.1	38.2	38.4	32.8	33.8	32.6	36.6	32.0	35.7	30.0
% increase lint	34	51	43	17	28	18	52	35	37	—
Mean length	25	23	26	22	27	25	27	26	24	26
Effective length	37	37	38	34	39	37	40	37	36	38
% dispersion	33	32	33	30	26	32	29	25	32	29
% short	36	39	37	39	34	35	34	28	38	31
% normal	60	54	57	54	46	41	46	45	48	42
% dead	4	8	8	12	14	11	12	11	13	16
M.H.W.	198	188	190	174	192	173	189	182	190	166
H.S.C.	27	27	27	36	47	43	39	31	29	48
C×S. at 40	1720	1734	1753	1890	2127	2046	1962	1838	1670	2124
C×W.R. at 40	1738	1814	2136	2264	2412	2257	2311	2130	1928	2490
Points	+65	+90	+80	+70	+80	+80	+75	+70	+50	+70

(VIII) Season 1937

Seven plants were selected from D5 in 1935, grown in progeny rows in 1936 and of these A26, and A28 were in a trial in 1937 (*see* Table VI).

This was rather disappointing because neither A26 nor A28 had maintained the strength of their parent D5. Hair weight was again high but in other hair characters they were as good as Allen. A 26 was however valued higher than Allen by the broker.

Table VI

	A26	A28	Allen
Yield S.C. ...	503	499	461
Lint	180	169	141
Gin per cent. ...	35.8	33.9	30.6
Per cent. increase lint	28	20	—
Mean length ...	26	25	26
Effective length ...	39	39	39
Per cent. dispersion	27	26	30
Per cent. short ...	36	40	37
Per cent. normal ...	53	46	43
Per cent. dead ...	18	21	27
M.H.W.	203	194	161
H.S.C.	—	—	—
C × S. @ 40 ...	2089	2159	2270
C × W.R. @ 40 ...	2577	2362	2669
Points	+65	+55	+60

(IX) Season 1938

In 1938 A26 was again under trial and with it was included D5 (really a mixture of all the strains derived from plant D5). The results are shown in Table VII and were disappointing.

Thus A26 was more regular and more mature than Allen but had a higher hair weight and was again weaker. (It was in fact no better than its parent D5.)

Although details of other selections from D31 are not given here it should be mentioned that some of them were considerably more promising than A26 but fortunately A26 was not discarded and strain 26 which was selected from it as a single plant in 1936 was grown as a progeny row in 1937 from which were made 4 more selections.

Table VII

	A26	D5	Allen
Yield S.C. ...	459	471	378
Lint	162	161	110
Gin per cent. ...	35.3	34.2	29.1
Per cent. increase lint	47	46	—
Mean length ...	24	23	21
Effective length ...	36	36	36
Per cent. dispersion	29	30	30
Per cent. short ...	37	41	44
Per cent. normal ...	47	38	45
Per cent. dead ...	20	25	27
M.H.W.	185	173	161
H.S.C.	42	42	50
C × S. @ 40 ...	2046	1056	2217
C × W.R. @ 40 ...	2434	2357	2747
Points	—	—	+35

Strain 26 itself was never sent for analysis to the Shirley Institute but in 1939 Strain 26C which was one of its progenies was in trial A4 (39) and the results are presented in Table VIII.

Table VIII

	26C	Allen
Yield S.C.	528	404
Lint	202	127
Gin per cent.	38.3	31.4
Per cent. increase lint ...	60	—
Mean length	28	26
Effective length ...	38	36
Per cent. dispersion ...	28	25
Per cent. short	21	32
Per cent. normal	61	52
Per cent. dead	12	19
M.H.W.	208	183
H.S.C.	41	43
C × S. @ 32	2148	2243
C × W.R. @ 32	2636	2833
C × S. @ 40	2045	2075
C × W.R. @ 40	2556	2512
Points	+125	+110

Thus the good quality of the original D5 which was disappointingly lacking in A26 was regained in the strain 26C. It was only very slightly weaker than Allen but it had a better length, less short hairs and was more mature. It still had the higher hair weight characteristic of all the D31 progenies but it was valued higher by the broker and above all had an increase in yield of 60 per cent. lint which had been the main goal provided quality did not suffer in the process.

D5 and A26 were also in a trial—B1 (39)—this year. The results need not be given in detail but A26 was again weaker than would have been expected from its measured hair characters. D5 on the other hand was stronger with a highest standard count of 40 compared with that of 38 for Allen.

(X) Seasons 1940-43

Owing to war activities very little breeding work was carried out during this period, but 26C was maintained and in 1942, samples were sent for analysis. These two samples were not in a trial but were grown on adjacent plots. Thus yields are not strictly comparable but other characters are. The results are shown in Table IX.

Little comment is needed on these samples since they were so similar in quality. The findings of last year had however been confirmed and 26C was again equal to Allen in quality.

There were no trials in 1943 but samples of 26C and Allen were sent for analysis. Full results will not be given since the 26C sample was grown on our farm and the Allen was native grown grade I collected at Funtua ginnery. If the Allen sample had been a comparable control, the results would have been very flattering to 26C which was for once much stronger than Allen. When spun at 40's it had a Lea product of 2059 compared with only 1777 for the Allen sample

Table IX

	26C	Allen
Yield S.C.	378	368
Lint	231	114
Gin per cent.	39.8	31.0
Per cent. increase lint ...	103	—
Mean length	25	26
Effective length	37	38
Per cent. dispersion ...	29	27
Per cent. short	31	31
Per cent. normal	43	48
Per cent. dead	15	14
M.H.W.	183	169
H.S.C.	50	50
C × S. @ 40	2162	2180
C × W.R. @ 40	2614	2571
C × S. @ 50	2039	1998
C × W.R. @ 50	2406	2299
Points	+25	0

and the highest standard count for 26C was worked out as 42 compared with 27 for Allen. The two samples were similar to each other in length and maturity but 26C was a little coarser and the Shirley Institute remarked that the superiority of 26C could not be explained in terms of measured hair characters.

(XI) Disease

In each year when single plants have been selected resistance to disease has always been one of the main factors affecting the choice. The original D31 plant was recorded as free from leaf curl and jassid and in a trial in 1934 only 1.8 per cent of the plants were attacked by leaf curl compared with 14.2 per cent. of the plants in the plots of commercial Allen. Counts since then have not been made but it is known from observation that most of its progenies including Samaru 26C are only slightly attacked. This is probably one of the factors helping to build up the increased yield per acre of seed cotton.

(XII) Related Strains

At the time of writing, two strains from 26C are at the first trial stage and also many other related strains which are the progeny of D31. Some of these may ultimately prove themselves superior to 26C but in the meantime it has been decided by the Director of Agriculture to grow strain "Samaru 26C" in the cotton seed multiplication Farm at Daudawa with the ultimate idea of distributing it to farmers as a pure line. This year (1945) it has reached Stage I at Daudawa so it will first be distributed to farmers in 1947.

Meanwhile work continues and it is hoped that the high quality of 26C will be maintained and improved.

(XIII) Comparative Characteristics

The characteristics of each generation may be summarised as follows from figures obtained by averaging all the figures available for each strain. In each case the difference, either actual or percentage, is from strictly comparable control plots of commercial Allen.

Actual differences :—

Ginning Per cent: All much better than Allen and a slight tendency to increase (26C best).

Mean length: Fluctuates but all except D31 better than Allen.

Effective length: All better than Allen.

Per cent Dispersion: Fluctuates and 26C with +2.5 per cent. is the worst.

Per cent short: A definite reduction from +2.9 per cent. to −5.5 per cent. in the case of 26C.

Per cent. Normal: Fluctuates but generally better.

Per cent Dead: All generations better.

Valuation: Except for D31 all were valued higher by the broker.

Per cent differences :—

Yield S.C.: All better. Increase varies from 13 per cent. to 30 per cent.

Yield Lint: Increase in lint is greater than increase in seed cotton because of the increase in ginning per cent.

Hair weight: All definitely have a higher hair weight.

Highest Standard Count: All lower but 26C was nearly equal to Allen.

Lea Product: All lower except 26C which is 3 per cent. stronger.

Count × W.R.: 26C is 7 per cent. better but others are all lower.

(XIV) Conclusion

The writer wishes to point out that the breeding of Samaru 26C is the combined work of the staff of the Botanical Section (North) of the Department of Agriculture, Nigeria and that Mr. J. K. Mayo has until recently been in charge of the section.

OCCURRENCE OF AUXINS IN ORGANIC MANURES

According to an article by J. Hubert Hamence, *J. Soc. Chem. Ind.* **64,** 147-8, most organic manures contain auxin but the contents vary widely. The active substances are not always present in the form of B-indolyl-acetic acid. In some cases total auxins found by the pea test are equal to the B-indolyl-acetic acid shown by the perchloric reaction; in other cases the differences are relatively large. In general, animal manures contain more auxin than do other organic materials. Some representative values follow: the values are for total auxin calculated as B-indolyl-acetic acid, mg./100g., on a dry-weight basis, fresh farm yard manure 1.41, same material after 4 months 0.15; horse dung (no urine) 0.80; poultry manure (2 weeks old) 7.66; dried poultry manure 0.21-0.48; bone meal 0.11; dried blood 0.28-0.90; hoof meal 0.64; leaf mould 0.007. Injury observed from use of fresh poultry manure may be due in part at least to its excessively high auxin content.—(*Chem. Abstrs.* **39,** p. 4185).

A NEW METHOD OF MAIZE IMPROVEMENT

BY

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The yield of a commercial variety of maize may be considered as the combined yields of a large number of genotypes, about half of which give yields above the arithmetic mean and others below. These yields fall on a normal frequency distribution, the arithmetic mean of which coincides with the general mean of the variety.

If we could separate the combinations which contribute to the upper part of the curve, we could eliminate the inferior genotypes without causing loss of vigour by fixation of genes, and by initiating a new equilibrium in gene frequencies, produce a superior variety in a much shorter time than by the standard pure line method followed in the United States.

It has been found possible to do this by the following method.

1. From a commercial field select say 200 good plants, and cross in pairs to give 100 hybrid ears.
2. Compare the yields of these ears in several replications using one of the well known variety trial lay outs.

   It will be found that the yields fall on a normal curve and that the mean yield of all combinations is near that of the general variety. Some combinations, however, produce yields of 50 per cent. or more *above the commercial variety*.

   The problem now is to multiply these desirable hybrid genotypes in breeding populations sufficiently large. The subsequent procedure is as follows :—
3. Select the eight best combinations and sow in two plots.

   Plot 1. Plant alternate rows of (1×2) and (3×4).

   Plot 2. Plant alternate rows of (5×6) and (7×8).

   Detassel (1×2) and (5×6).
4. Plant the combined (1×2) × (3×4) and (5×6) × (7×8) in alternate rows and detassel the first combination.
5. Grow a large bulk from the combined (1×2) × (3×4) × (5×6) × (7×8) for commercial distribution.
6. Repeat the whole cycle.

Experiments conducted by the writer at the Institute of Cotton Genetics of the Sociedad Nacional Agraria of Peru have given preliminary yields of over 100 bushels per acre beginning with a variety upon which no form of selection has ever been practised.

It is so far clear that this method possesses considerable advantages over the standard pure line methods. It is cheaper and quicker, and the technique is well within the scope of small experiment stations in undeveloped regions, where rapid improvement of yield is urgent.

For forest trees, and seminally reproduced tree crops such as coconuts, and possibly cacao and rubber, the new method would appear to have a spectacular future.

A complete report will be published at a later date.

REVIEW

Science and Scientists in the Netherlands Indies

EDITED BY

PIETER HONIG AND FRANS VERDOORN

Published by the Board for the Netherlands Indies, Surinam and Curacao, New York City. Obtainable from The Chronica Botanica Co. P.O. Box 151, Waltham 54, Mass., U.S.A. Pp. 491. Price : $4.00.

All scientific workers in the tropics, and not least those concerned with the agricultural sciences, owe a debt to pioneer investigations in the Netherlands East Indies, and there will be few who will not find something of interest in this book. The volume of nearly 500 closely printed pages is difficult to review on account of the extraordinary range and diversity of the subjects it covers. Its scope may best be indicated by quoting from the Editors' Foreword.

" In this volume, " Science and Scientists in the Netherlands Indies ", we have endeavoured to present a picture of the development and status of a number of branches of the natural sciences, pure and applied, in the Netherlands Indies. The period during which this volume was prepared has been darkened by the military occupation of both the Indies and the mother country. This circumstance made it impossible to obtain the degree of collaboration necessary for a really complete history of science in the Netherlands Indies.

The present work consists of :

(1) Original articles, prepared especially for this volume, dealing with the development or status of various branches of science in the Netherlands Indies.

(2) Reprints of similar accounts previously published elsewhere, several of which originally appeared in Dutch and are now being made available in English.

(3) A number of travel accounts and impressions by distinguished visitors in the past, often offering delightful glimpses (scientific and otherwise) of life and nature in the Netherlands Indies.
(4) A number of shorter articles—notes, biographical sketches, reviews, etc. ("Serta Malesiana")—comprising material often of interest from the viewpoint of the promotion of North American-Netherlands Indies relationships.
(5) A list of scientific institutions, societies, and workers in the Netherlands Indies at the time of the Japanese invasion."

It only seems necessary to add that the book is well printed, illustrated and produced. The editors are to be congratulated on a useful and interesting compilation.

E.E.C.

A HOOD TO PROTECT PRECISION INSTRUMENTS IN THE TROPICS

BY

DAVID G. WHITE

(*Plant Physiologist, Federal Experiment Station, United States Department of Agriculture, Mayaguez, Puerto Rico*)

IN tropical regions precision instruments require protection from humid atmospheres which are conducive to corrosion and to the development of a glass-etching fungus. Such equipment is often stored in a closed cabinet furnished with an electric light bulb or other heating unit. However, a cellulose acetate hood, as shown in Figure I, is more economical and is readily accessible on the worker's desk or table. This hood can be made air-tight by cementing the edges with acetone; warping will not occur if small pieces of cellulose acetate are first dissolved in the acetone. The cylindrical shape is maintained by three wire hoops which are attached to the inside of the hood with adhesive tape. The bottom of the hood is placed in metallic mercury contained in a circular groove 1/4 inch wide and 1/2 inch deep lathed in a wooden base. The mercury forms an air-tight joint which is not sticky like the usual vaseline seals. Rings of soft rubber hose tacked to the inner and outer edges of the groove so as to be in contact over its center also make an air-tight joint when the bottom of the hood is slipped between them. This latter type of seal is preferable in laboratories where vaporized mercury may injure plants. A dry atmosphere is maintained within the hood by placing calcium chloride in a container beneath a small wooden table which supports the instrument. Biological supply houses offer similar hoods which can be used provided they are sufficiently high to accommodate both the inner table and the precision instrument.

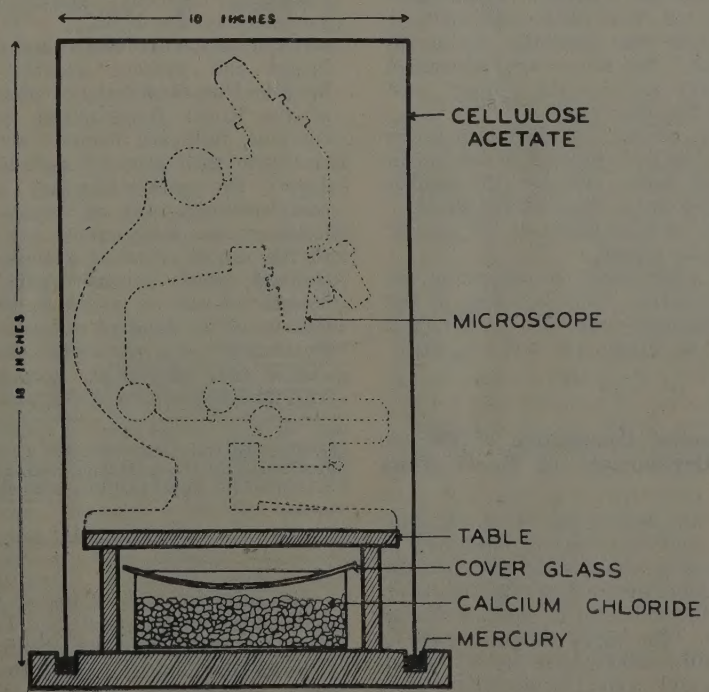

FIG. 1

CHEMICAL NOTES

(Compiled by the College Department of Chemistry and Soil Science)

Effect of Mulches on Soil Properties

Western Oregon has a large quantity of grain straw and the residues from various seed crops and other similar materials of potential value for mulching. Only a small portion of these materials is used for bedding in stables or applied directly to the soil. The burning of stubble and of straw stacks is a common practice. A study to define more accurately the value of such waste products, especially when used as a mulch, should be conducive to their conservation and more effective utilization, particularly since orcharding and small-fruit production in Western Oregon lend themselves to mulching practices.

These are the considerations that prompted this study to determine the effect of mulching upon the conservation of moisture, the nutrient supply for crop production, and the structure of the soil.

Summary: Moisture conservation, nutrient supply, and soil structure were compared on six treeless plots under different treatments–uncultivated sod, scraped and kept bare of growth, tillage mulch, spaded rough, straw mulch, and trash mulch and on an adjacent orchard in sod.

The straw mulch saved moisture equivalent to 2 or 3 inches of rainfall in dry weather. The moisture saving was principally in the upper 2 feet of soil. The trash mulch had a lesser moisture-saving effect.

Nitrates were as high under straw mulch after it had been established for 3 years as under clean cultivation. The soil that was cultivated or mulched with straw was generally higher in nitrates than the plot that was scraped to control vegetation, probably because the scraped plot became drier than the other plots.

The straw mulch caused a marked increase in soluble potassium but little increase in calcium in the topsoil. Trash mulch increased the soluble potassium to a lesser extent than did the straw.

Straw and trash mulches increased the organic matter content of the topsoil.

Both straw and trash caused an increase in the water-stable aggregates. The increase in the larger aggregates was most noticeable. (Abstracted from *Soil Science* Vol. 59, pp. 219 and 229, 1946).

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Influence of Chemical Composition of Organic Matter on Development of Mould Flora in Soil

According to an article by T. L. Martin, D. A. Anderson, and Rex Goates published in *Soil Sci.*, **54,** p. 297, changes in the chemical composition of organic materials as they undergo decomposition in the soil seem to effect a change in the mould flora. The higher the percentage of readily decomposable carbohydrate materials, *i.e.*, sugars, starches, and some hemicellulose and cellulosic materials, the greater the predominance of species of *Mucor* and *Rhizopus* in proportion to other moulds present in the soil-organic matter mixture. When a stable hemicellulose and cellulose fraction has been produced in the soil, little of the more easily decomposed carbohydrate material remaining, moulds which presumably prefer this material, *i.e.*, *Penicillium glaucum* and *Aspergillus niger*, predominate. When lignin is the chief constituent remaining of the original plant material, species of *Cladosporium*, *Alternaria*, and *Aspergillus minutis* are found in greatest number.

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Humus *v.* Artificial Manures

The origin of the "humus only" campaign is probably mainly psychological; hatred of scientific warfare leading to a generalised distrust of all scientific applications as opposed to the unaided operations of Nature. Strangely enough, basic slag, a most complicated chemical compound, and lime (almost pure calcium carbonate) are exempt from these prejudiced attacks. One of the evils laid at the door of users of chemical fertilisers—the "dust bowl" of the U.S.A.—has recently been refuted by Dr. E. M. Crowther, of the Rothamsted Experimental Station, England, who produces statistics to prove that the use of fertilisers in these areas is almost negligible. The trouble, as he states, is due to too frequent ploughing. Recent attacks by ill-informed gardeners in the B.B.C. "In Your Garden" series of talks were resisted and shown to be quite biased and without scientific foundation by Sir John Russell of Rothamsted and Mr. Simmonds of the Royal Horticultural Society, who put compost, farmyard manure, and fertilisers very clearly in their proper perspectives in a broadcast. The rational policy advocating the complementary use of organic and inorganic fertilisers was fairly stated. A striking example of the use of chemical fertilisers is afforded by Holland, which country applied these fertilisers before the war at six times the rate of Great Britain. The standard of health enjoyed by the Dutch is almost a byword in Europe and the death rate in 1937 was 8.7 per 1,000 as compared with 12.0 for England and Wales, and 14.3 for Ireland.

(Abstracted from a summary of a lecture on "Chemical Fertilisers" by Dr. E. Mayne Reid, given to the Belfast Section of the Royal Institute of Chemistry.)

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